City University London

OFCOM

FEASIBILITY OF ADDITIONAL TELEPHONE RELAY SERVICES

FINAL REPORT
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Executive Summary

This is the final report of a feasibility study commissioned by Ofcom about additional telephone relay services for deaf and speech-impaired people. Following the remit, it focuses particularly upon video relay, but also considers captioned relay and speech relay.

Views of a wide range of interested parties were sought. The views of deaf people and interpreters were obtained through self-completion questionnaires and individual interviews (in sign language, if appropriate). The deaf participants included users and non-users of the existing fledgling video relay services. In addition, many key stakeholders including communication providers have been interviewed.

Generally, deaf people interviewed are very enthusiastic and realistic about video relay.

Although the number of completed questionnaires from users of the existing fledgling video relay services was relatively small, video relay clearly does much to promote independence and is favoured by many sign language users because of its ease, speed (once installation problems are resolved) and suitability to convey emotion. Existing users tend to see video relay as a communication equality issue rather than a service for which they should be prepared to pay extra. To date, the majority of communications tend to be work-related or with friends and relations, and it has tended to replace telephone contact that previously involved their own third party helper. Existing users expect to use the service more frequently in future, some several times a week or even several times daily.

Sign language users who have not yet used video relay display a realistic, but very real enthusiasm about its potential. They too see video relay provision as an equality issue to give them better access to the telephone network and decrease their need for help on the telephone. They see it as broadening their access opportunities and forming a very significant part of their telecoms usage strategies. They have concerns about technology, cost and interpreter quality.

Generally, interpreters view video relay positively with more than 80% of those completing questionnaires willing to undertake it. The vast majority, however, wanted to do it part-time (one day a week). More than half were happy to interpret both from a home base (where most said they had a suitable space) and from a centre. Interpreters thought that video interpreting required significant experience, and that some additional training might be appropriate. Pay rates were expected to be the same as for face-to-face assignments. Interpreters viewed the greatest advantage of video relay as enabling a more efficient use of their time. The most pressing disadvantage they foresaw was interpreting a two-dimensional image – but

most active video interpreters thought that this would ease with experience. Interpreters anticipated new types of assignments on video relay that would be shorter and would more closely resemble hearing people's use of the telephone.

Video communications technology is improving rapidly and broadband has overtaken ISDN as the best form of delivery. A new video codec (H.264) has greatly enhanced picture quality without requiring increased bandwidth. Nonetheless, many existing legacy systems provide borderline solutions and the wide variety of end-user equipment incurs difficulties in providing support to users. There are several technical issues (such as non-fixed IP addresses, firewalls and Network Address Translation) that require significant resources to resolve. However, as video communications technology becomes more mainstream, these difficulties are likely to diminish. In mobile communications, GSM is too slow for video relay, but 3G is just about usable. Evidence from Sweden suggests that deaf users have a greater tolerance of poorer quality images on mobile telephony. Future mobile videophones are likely to be IP-based and compatible with fixed-line video communication.

Estimating demand for video relay is very challenging, since it is a little-known service within a relatively small community of potential users from which this research has only been able to take a small sample. Many respondents saw the issue as one of equality rather than cost. Nonetheless, the evidence that is available from a number of sources is surprisingly consistent. Three sources suggest that weekly users might number between 2,000 and 4,500 within a relatively short space of time -- but a lot of unrealistic assumptions are built into all of these calculations and they need to be treated with extreme caution.

Demand of course is multi-faceted and in the context of this work we have not been able to evaluate the demand for video relay from hearing people and organisations wishing to communicate with sign language users. Nonetheless, the indications are that speed and similarity of video relay conversations to voice conversations will assist their acceptance and drive demand from non deaf people.

Additional relay services require funding to keep call charges similar to voice tariffs. There is no obvious best source of funds, but there is a model from the USA that imposes a levy on operators which could be adapted to the UK, and there are several government departments which it can be argued have good cause to provide some funding. Other ideas also emerged, relating funding to Disability Discrimination Act responsibilities and to third party ownership of relay infrastructure with tendering for service supply.

There would appear to be a reasonable level of commitment in principle to the provision of additional relay services from two of the biggest telecoms providers, but key issues must be addressed: regulatory requirements to

share costs and commitments; the appropriateness of services; the technological platforms and developmental potential for future relay services.

The number of people who might potentially benefit from captioned relay is very high – between 420,000 and 1.2 million people are thought to have great difficulty in using voice telephony. Many, however, are elderly, so uptake will be very much less. Although a proprietary service does exist, it is regarded as being expensive and is used almost exclusively with support through Access to Work funding. Nonetheless, captioned telephony is being very strongly advocated by hard-of-hearing people and their organisations. A captioned relay could be integrated with a text relay service and improving speech recognition is likely to enhance current provision.

There is little awareness of the potential of speech relay in the UK. Further research is needed concerning the communication needs of speech-impaired people to find the best means and appropriate service opportunities to assist them.

Acknowledgements

We are indebted to the generous help of many people during the course of this study. In many respects that support in itself indicates the widespread enthusiasm for additional relay services.

We would like to thank all the individual deaf people who responded and to the deaf clubs of Leeds and Oxford who facilitated our visits. Each of the three main fledgling services, in the RNID, Significan't and the BDA, were very generous with information and patient with our enquiries. Interpreters gave freely of their time to answer questions and some were particularly helpful in opening up new contacts for us. The RNID, RNID Typetalk and Hearing Concern were very helpful in helping us to estimate numbers of deaf and hard-of-hearing people in particular categories. BT and Vodafone representatives were very informative of their positions. Teletec set up a Captel conferencing facility and have given us excellent leads in the USA.

Context and Aims

It is Ofcom's duty under the Universal Service Obligation, which is defined by an EU directive, to ensure that basic fixed line services are available at an affordable price to all citizens and customers across the UK. In particular, it is its duty to bring these benefits to groups of people whom the market might exclude.

Disabled people are one such potentially excluded group, especially those who are unable, or find it difficult, to use ordinary voice telephony. The text relay service, in which text is translated through an operator into voice and vice versa, is an important element of Universal Service, enabling deaf and hard-of-hearing and speech-impaired people to communicate with hearing people. While text relay is an invaluable service, it does not fully cover the needs of all those who find it difficult or impossible to use voice telephony.

There are three main groups to whom this applies:

- deaf people whose first or preferred language is sign language;
- hard-of-hearing people who prefer to use their own voices, but who would like a hearing person's voice to be accompanied by text to ensure that they can understand what is being said;
- speech-impaired people whose disability also makes it difficult for them to type text.

In the light of changing technology and the advocacy of groups representing the interests of deaf people, Ofcom has commissioned a study into additional relay services which could better serve the needs of these groups. The essence of the study is to determine the need and benefit for such services, and whether they can be achieved at a reasonable cost with the technology available.

Aims

The aims of the study, which City University was commissioned to carry out, are to consider extensions to the national relay service which would serve the needs of these three groups:

- a real-time video relay service for sign language users;
- captioned telephony for hard-of-hearing people who would be assisted by text accompanying other people's speech;
- speech relay for people with indistinct or faint speech.

Video relay enables deaf people to communicate in sign language with hearing people who are using an ordinary telephone. The deaf person signs to an interpreter, who is connected by a video link (videophone or computer and webcam). The interpreter conveys the message in speech to the hearing

person. It is similar to the existing text relay service (RNID Typetalk) but the deaf person signs instead of typing on a textphone.

Video relay has to be distinguished from *video interpreting*. Video relay is a telephone service, with the deaf person, interpreter and hearing person all in different places. Video interpreting is remote interpreting, where the deaf and hearing person are in the same place, but the interpreter is elsewhere.

Captioned telephone relay enables people with varying degrees of hearing loss to use (or more easily use) the telephone by displaying the text of the conversation on a special phone (or a PC). The person with hearing loss voices their part of the conversation in the usual way and can read the text and/or listen to the incoming speech.

A speech relay service is one in which a relay operator re-voices the speech of someone who has a speech impairment, but who can speak with an indistinct or faint voice, or with speech prosthesis. Speech relay avoids the necessity of typing, so may be particularly useful for speech-impaired people who also have dexterity problems.

The key objectives of the study are:

Video relay: to examine technical issues especially picture quality and platforms, the size of the potential market, and the potential costs for equipment and operations.

Captioned relay: to examine the technical feasibility of a non-proprietary captioned telephone service, the nature of an appropriate platform, the potential costs of speech recognition and the potential demand for the service.

Speech relay: to examine the potential demand for the service, the availability of suitable relay communicators and whether such a service can be part of a text relay service.

Research Methods

Video relay study

Information for the video relay study has been obtained principally from three sources:

1) the three main fledgling video relay services in the UK – run by RNID, Significan't and BDA;
2) questionnaire surveys and interviews with sign language users who have and who have not used video relay services, and of sign language interpreters;
3) existing services elsewhere, in the US and Sweden.

The study's technical expert has also reviewed the current state of technology for video relay.

Visits to UK video relay services

A checklist of questions – including technical aspects and current running of the services – was developed and interviews were arranged with those running the three main services. The interviews were tape-recorded, and follow-up questions were asked by phone and email.

Demand for a video relay service

Determination of the demand for a widely available video relay service is a key feature of the study. To investigate this, the widest range of sign language users was sought. In the short time available for the study (approximately 12 weeks only), the most appropriate means of reaching these people was through a large mailing of questionnaires to groups of sign language users. However, since some sign language users are not comfortable in using written English, sign language interviews were also offered. The questionnaires and deaf websites' publicity offered face-to-face interviews at City University and at two deaf clubs (Leeds and Oxford). We were able to arrange interviews for most, but not all who wanted them, difficulties being the timely availability of interpreters and the cost of interpreters. Some sign language interviews were also carried out by the deaf adviser we appointed to the study, rather than a sign language interpreter.

Questionnaire for sign language users who have not used a video relay service

A questionnaire for sign language users who have not used a video relay service was designed after visits to the UK's three fledgling services. The wording was checked by the deaf adviser, and it was sent for comments to organisations who had agreed to mail it to people on their databases.

Mailings took place to:

- 377 people on the Typetalk database of people who had agreed to be sent publications and who had been identified as sign language users (referred to as the Typetalk sample in this report);
- 300 randomly selected people on the database of SIGNMatters (the magazine of the BDA);
- 35 people who had bought videophones from Significan't, but who were not using the Significan't video relay service.

Other respondents to the questionnaire were recruited from:

- a letter of invitation to people who had responded to City University's Text Communication survey of 2003-4, and who used sign language, for whom contact details were available
- a questionnaire on the website created specially for the study – www.addrelay.org.uk
- publicity on websites of deaf organisations and television's Read Hear
- a link to the questionnaire on the NDCS website and publicity to NDCS local groups
- a letter to 12 deaf schools with secondary level students
- requests from non-video users from the RNID's mailing to people who had shown an interest in video relay
- arrangements with two deaf clubs where sign language interviews were carried out;
- a widely-advertised sign language interview session at City University.

Questionnaire for people who had used a video relay service

After visits to the three main video relay services in the UK and discussions with deaf people and their advisers, a questionnaire was designed for people who had used a video relay service. An in-depth interview using a sign language interpreter was also carried out with a staff member at one of these organisations, who personally uses its video relay service. To try to ensure comprehension, the wording of the questionnaire was checked by the deaf adviser and a draft questionnaire was also sent to the organisations who had agreed to send out this questionnaire – RNID and Significan't.

RNID sent out 190 email questionnaires and about 250 postal questionnaires to people on their database who had shown some interest in video relay. The total number is uncertain as they say that there may have been some overlap between the mailings. Significan't sent out 35 forms to video relay users.

Availability of interpreters

Availability of sign language interpreters is also an essential for a viable video relay service. To obtain interpreters' views, a questionnaire was developed after exploratory interviews with three interpreters working for one of the UK video relay services, and a draft questionnaire was commented on by them and revised. The questionnaire was emailed to all interpreters with available email addresses on the ASLI website, and was also put on the ASLI website, and on an e-news group for interpreters run by an interpreter. Several follow-up telephone calls were made to interpreters who had experience of video relay or video interpreting.

Quantitative analyses

For the quantitative analyses, data was input to SPSS. In the tables, figures are rounded up or down to the nearest whole number, except where the decimal is .5. Statistical significance refers to the 5 per cent level using the Chi-square test.

Other existing services

A visit was made to Omnitor, Stockholm, supplier of equipment to the Swedish video relay service, using the same checklist as for the UK services, this interview also being tape-recorded. Statistics on use of the Swedish service have also been obtained.

Statistics from the US video relay services, and other information available on websites about the various US services have also been used.

Captioned relay, speech relay and other aspects of the study

Information on captioned relay, speech relay and other elements of the study were gathered through desk research and open-ended interviews with key personnel.

Video Relay

Users' views of video relay

Although the number of completed questionnaires from users of the existing fledgling video relay services was relatively small, it was clear that video relay does much to promote independence and is favoured by many sign language users because of its ease and speed (once installation problems are resolved). Existing users tend to see video relay in terms of a communication equality issue rather than a service that they should be prepared to pay extra for. To date, the majority of video communications tend to be work-related or with friends and relations, and it has tended to replace telephone contact that previously involved their own third party helper. Existing users expect to use the service more frequently in future, some several times a week or even several times daily.

Short summaries of a project that set up a video relay service for a number of deaf people aged 50+ in Bristol, and of a trial of video relay and video interpreting using 3G mobile phones in Sweden are also included in this section.

Respondents

The actual number of completed usable video relay users forms is relatively small – 17 – but is nonetheless a sizeable proportion of existing video relay service users. Sixteen of the forms were self-completed, and another obtained through a sign language interview with an interpreter. However, two of those who completed the form also asked for a sign language interview, which was subsequently carried out by our deaf adviser, who was able to obtain some additional information and points of clarification.

We also received nine non-user forms completed by people who say that they are video relay users, and who received the form through the Typetalk or SIGNMatters or school mailings. They have not been included in the main analyses in this section, but their experiences with video relay are discussed later in this section.

We have additionally received a few unusable forms mostly because the replies were ambiguous – a result of low written English literacy levels.

Characteristics of video relay user sample

There were nine men and eight women in the sample and they represented almost the full spectrum of working ages (Table 1).
Table 1 on next page.

Table 1

Age	No.	%
25-34	6	40
35-44	3	20
45-54	4	27
55-64	2	13
Total	**15**	100

While three-quarters (76.5%) were white, there was quite a high proportion from other ethnic groups, two people saying that they were Asian or British Asian, one mixed and one 'other'.

Eleven were in full-time employment (69%), two self-employed, one in a part-time job, and two were unemployed looking for work. This high level of employment is partially due to the fact that six are employees of one of the organisations that is providing one of the fledgling video relay services. However, video relay is more likely to be used by people at work, as they will already have access to a PC and because of the relay service current opening hours (9am to 5pm weekdays).

Methods of communication used

Table 2
Methods of communication

	No.*
BSL	16
SSE/Total Communication	5
Speaking	5
Lip-reading	6
Writing	3
Other	1
Total	17

** Percentages do not add up to 100 as more than one mode of communication may apply.*

Eleven respondents said that BSL was their preferred method of communication, three SSE/Total Communication, one speech and one lip-reading.

Where video relay service is used

Ten respondents used the video relay service from work, four from home (though one also worked part of the time at home), and two from both work and home. One said that they used it 'at any access point I can find', but did not make it clear where the access points were.

Current and future use of video relay

With the fledgling services, current usage of video relay is inevitably quite low (Table 3a). The most frequent level of usage (40%) was "very rarely". However, when asked about their future use of video relay services, most expected their usage to substantially increase and be at least "a few times a week" (80%).

Table 3a
Current and future use of video relay

	Current usage	Future usage
More than 5 times a day	1 (7%)	2 (13%)
2-5 times a day	-	1 (7%)
Once a day	-	1 (13%)
A few times a week	4 (27%)	7 (47%)
Once a week	1 (7%)	1 (7%)
A few times a month	3 (20%)	-
Once a month	-	-
Very rarely	6 (40%)	2 (13%)
Totals	15	15

Table 3b shows that, apart from two individuals who still say that they will use the service "very rarely" in the future, everyone indicates that they will increase their usage.

Table 3b
Current and future use of video relay

	Future - more than once daily	Future – once a day	Future – a few times a week	Future – a few times a month	Future - very rarely
Currently - more than once a day	1	-	-	-	-
Currently - few times a week	2	1	1	-	-
Currently - once a week	-	-	1	-	-
Currently - few times a month	-	-	2	1	-
Currently - very rarely	-	1	3	-	2

What is video relay used for?

Work and family communication are the main uses of video relay by existing users. This reported usage pattern broadly reflects the usage expected by future users, although the actual percentages are a little less than anticipated usage of current non-users (see Table 10, Non-users' section).

Table 4

Who existing users contact through video relay

	%
Hearing friends/relatives	59
For work: colleagues and customers	59
For health: GP	41
For education: schools, colleges etc	29
"Other" companies (eg gas, electric)	29
Social Services	24
For health: hospital	18
Local council (other issues)	18
For travel: timetables, costs etc	18
Shopping and entertainment	12
Legal (eg solicitor)	6
Other	6
Looking for work (eg Jobcentre Plus)	-

Changes in communication modes

While video relay does not appear to have changed the amount of email, texting and instant messaging by respondents, it does seem to have replaced some phone usage that required third parties, including text relay (Table 5).

Table 5
Change in communication modes since video relay

	% Use about same as before	% Use more than before	% Use less than before
Text (via mobile)	100	-	-
Email	100	-	-
Instant messaging	100	-	-
Visit or meeting with interpreter	83	-	-
Phone with help of social worker/interpreter	71	-	29
Phone with the help of colleague	71	-	29
Phone with help of friend/relative	63	-	37
Fax	56	-	44
Typetalk (RNID)	55	9	36

Has video relay changed communication quality?

Respondents generally thought that video relay had improved the ease and quality of their communications. Several said it was much easier to explain complex issues in sign language, and that it is quicker than typing, more comfortable and more personal.

- *I like to use VRS as it helps me to communicate with hearing people easier as the interpreter help to relay the conversation in BSL, and the conversation is more natural than typing as you can see the mood, which makes a huge difference for a conversation, either professionally or for socialising.*

- *Yes, before it was difficult to explain what I want to say on fax or Typetalk – but now with video relay the interpreter can understand what I want to say and able to get my message across to third party.*

One respondent said that he communicated with

- *a wider range of people, more clients and I feel more part of the society.*

However, two respondents said that technical or access problems were preventing any use of video relay at the moment.

Installation at home

Video relay users who used the service from home had a variety of equipment:

- three were using a PC and webcam,
- two (actually a couple who answered separately) a videophone set-top box and TV,
- one did not specify his equipment.

Most of those who used the service at home with computer and webcam had installation problems and one had broadband speed issues. Getting a fixed IP address was also mentioned as a problem. Examples of users with problems are given to illustrate these.

- One of those with a PC and webcam had received free trial software from the video relay service provider and instructions on how to set it up. It first worked well, but then would not work, and it wiped out the Windows XP Net Meeting. She could not understand the instructions document, and wished for instructions in BSL. She uses MSN to chat to other deaf people frequently.

- Another used the service satisfactorily until the software changed from ENVISION to VCON. At first the picture quality was very good, but then he could not connect. The video relay service provider is working with him to try to solve the problem.

- The third person uses a laptop with a wireless-connected camera. He tried to set up the video service provider's software but the picture was not good, and it crashes a lot.

- In addition to these home video relay users, one respondent had tried all three of the main UK services at work, using a computer and webcam, and says that despite technical assistance it took four months to set up one system, while another is still not working after seven months.

Cost of video relay calls

Communication as a right was a frequently encountered theme throughout the study. Eighty-two per cent of the respondents said that they would not pay more than the cost of an ordinary phone call for a video relay call.

One respondent said: 'They have access in the US. Most deaf people are lower earners. It is the government's responsibility to make equal access.'

Advantages of video relay

From multiple-choice options, video relay users articulated the ease of communication through sign language, especially in terms of speed and expressing emotion (Table 6).

The significance of sign language relay was explained by one respondent who said that English was not his first language:

> *Typing is brief, not in depth, you have to change to English.... Email is English structure, you may not understand the full meaning.*

Several respondents preferred video relay to text relay, for example:

> *Too many hearing people advise me not to use Typetalk as they loathe the "tone" of voice or the length of time involved in passing a simple message.*

Another, who runs his own business, books a BSL interpreter frequently for telephone calls. He found that text relay put off potential clients because they thought that they were marketing "cold calls".

Table 6
Advantages of video relay

	%
Can use signing	94
Can express emotion	77
Quicker than typing	77
English is not my first language	29
Gives more independence	59
Other	18
Total	17

Disadvantages of video relay

There is less consensus about the disadvantages of video relay. We suspect however that difficulties in installing at home are a greater problem than reflected in the table (Table 7).

Table 7
Disadvantages of video relay

	%
Third person in conversation	18
Differences in sign language	24
Difficulty in understanding signing on screen	35
Difficulty in installing at home	24
Expense in installing at home	17
Other	20
Total	17

Comments included the need to sign more slowly, and a preference for a regular interpreter who has some background information, rather than having to approach different interpreters. The difficulty of signing names and

telephone numbers was also pointed out, and the consequent need for a complementary and parallel text facility.

What stops respondents from using video relay more?

Respondents mentioned the technical problems that they were having, also that it was not available out of work hours, and that there is not a facility for hearing people to call them.

How calls are received by hearing people

There seemed to be some difficulty in understanding this question, some people thinking it meant receiving calls from hearing people, and only 11 people replied. All but two said that there were no problems, and two that there were sometimes problems.

Do respondents recommend video relay to other deaf people?

Half of those replying to this question (15) said that they recommended it to all deaf signers, and another quarter to a few. Those who did not offer recommendations did so because of the technical problems they had experienced. One would have recommended the service strongly if it had been available on mobile telephones since most of his contacts had mobiles.

Signing to other deaf people via video link

Of the 15 responses about direct video-link signing to other deaf people, one-third (5) said that they did it "often'", and another six "sometimes". Three who did this often were having technical problems with video relay. Two said that they had no problems using MSN for this, one saying that MSN 7.5 (the mainstream video and Instant Message facility) was "brilliant".

Experiences of users completing non-user form

Nine sign language users who were sent a non-user form in one of the mailings completed it, despite saying that they had used a video relay service. They all said that they had seen video relay, and all but one had used a videophone or PC and webcam to sign to other deaf people (four had done so regularly). From the information on the forms it is difficult to know how much they were using video relay services, and in some cases comments suggest that they may only have tried it out at a demonstration provided by one of the three fledgling services, or at work or college. Four agreed with the statement that the expense of the equipment was stopping

them from using video relay, and one was having problems with picture quality. One said –

> *it will help people to be confident and less ask for help from interpreter or social worker…*

but that they were stopped from using it because –

> *people have no got videophone at their home or in local library or deaf centre, also they have no information about it.*

Another said –

> *It would be interesting – emotion-based, and I'm fluent in BSL. The problem being the equipment.*

One of the nine however contacted the research team by SMS and email, and was a heavy user of video relay. He used all three of the fledgling services, and also a specialised service funded for a particular project. He mainly used the service from work, and liked the ISDN videophone there as the quality was consistent, while IP quality was variable. He made five calls or fewer on a normal day, and 10 or more on a busy one. He said:

> *I love the videophone/video conferencing. I think best thing happen to BSL users. And you can give more clear information. Depend who interpreter??.*

He wanted '24 hours+365 days service'.

Experiences of users in SIGN50 project

Sign 50 was a project in which videophones were installed in the homes of 22 deaf people, aged 50+, living in Bristol (Clarke and Kyle, 2004)[1]. An interpreter was available for three four-hour sessions a week, from April to November 2003.

During the operational period of 110 hours there were 122 calls made, an average of 5.5 per participant. The limited availability of the interpreters probably means that calls were less frequent than they would have been with a 9am-to-5pm service. However, the number of calls was boosted by interpreters taking a pro-active role and calling the participants at designated times to find out whether they wanted to make a call. Thirty-three calls were

[1] Clarke, M. and Kyle, J. (2004) *Sign at 50+. Enabling Visual Communications for Older Deaf People.* Bristol: Deaf Studies Trust.

to family members or friends, 16 for health reasons, 15 to council departments (the project explained to participants about services provided by the council), 6 to book interpreters, and most of the others to companies, including a gas company, water board, builder, electrician, hairdresser.

The authors of the study believe that most of these transactions would not have taken place without the video interpreting service.

Swedish trial of mobile communication for deaf people

A trial of the use of 3G mobiles for deaf sign language users was conducted by the Swedish National Post and Telecom Agency (PTS) (2005)[2].

One aspect of the trial was an evaluation of a video relay and video interpreting service for 3G users. They report that deaf people were already enthusiastically using 3G mobiles. Although the number of deaf users was not definitively known (it was thought to be about 4,000–6,000) it was much higher than in the general population.

The service was limited in its hours, initially Monday to Friday 9am to 12pm, and after November to 3pm. The number of participants allowed to use the service was also limited, starting with 17 and increasing to 54 by December 2004. A total of 710 calls were made during the 140-day trial period (6 September 2004 to 18 March 2005), 97% being for relay rather than distance interpretation.

Participants used ordinary 3G mobiles that met only the minimum resolution (176*144 pixels (QCIF)) and frame rate (10-14fps) requirements for sign language communication. There seems to be a greater tolerance of the limitations of mobile as compared to fixed communications. The majority of people paid a fixed monthly sum, and then had free calls within the operator's network, a model that was favoured by most of the deaf people. A high percentage (13%) of calls were not connected or were interrupted, for technical reasons. There were also problems in that 3G did not function everywhere and batteries ran flat rapidly.

Despite all these limitations and problems the response of the deaf participants in the trial was very positive. The most common comment about

[2] Swedish National Post and Telecom Agency (2005) *Mobile video communications for people who are deaf*. Available at: http://www.pts.se/Dokument/dokument.asp?ItemID=4615 (Retrieved 5.05.2006)

the relay and interpretation service was that it should become publicly available with longer opening hours.

In an evaluation conducted by Linköping University with 33 trial participants, 15 out of 20 respondents thought that their quality-of-life had improved. Participants emphasised the value of being able to communicate in their own language while being mobile, and the flexibility it provided. The evaluation concluded that there would be considerable potential benefits with wider 3G coverage and longer operating hours.

Conclusions

The sample of video relay users in our study was small, but respondents have interesting things to say, both about the advantages of video relay and its current limitations in the UK. Undoubtedly, sign language users consider that it is much easier to express themselves in sign language than in English, that it is quicker and that it enables them to communicate more easily and accurately with hearing people. Usage is relatively small at the moment by this group, although all but two expect it to increase in the future. There are many current constraints: technical installation and broadband problems, the limited hours of access, the lack of a facility for hearing people to call them.

It is difficult to say how representative the sample is of current users. Our information from the services would suggest that numbers are quite small still. Are technical problems over-exaggerated, in that those with such difficulties were more eager to respond to the questionnaire, so that they could air these problems? This is possible, and information from the providers and interpreters would suggest that there is a small number of 'full users'. However, we do also know that one provider is currently working hard to resolve the different individual problems of those using a PC and webcam. So technical problems do currently appear a very real inhibiting factor.

One respondent remarked on the need for awareness of video relay among deaf people:

> 'It would be nice to see more deaf to use video relay. Not many deaf are aware of this. Some are not sure about using new technical things. They need to see it for themselves to see how easy and convenient it is.'

Increased usage needs the technical problems being overcome, and greater awareness in the deaf community.

Non-users' views of video relay

Sign language users who have not yet used video relay display a cautious enthusiasm about its potential. They too see video relay provision as an equality issue to give them better access to the telephone network and decrease their need for help on the telephone. They see it as broadening their access opportunities and forming a very significant part of their telecoms usage strategies. They have concerns about technology, cost and interpreter quality.

Respondents

Altogether, 144 completed non-user forms have been received. A number have not been used in the analysis here for various reasons including:

- 4 from the Typetalk sample, 3 from SIGNMatters, one from Significan't and one from a school, as they appear to be video relay users. They have been discussed in the section on video relay users.
- 6 from the Typetalk sample, one from SIGNMatters, and one from the Text Communication survey who do not appear to be sign language users;
- One hearing person from SIGNMatters.
- One non-signing lipreader who wanted to use video relay
- 5 (including one from Typetalk and one from SIGNMatters) whose forms arrived too late to be included.

The following analyses relate to 120 sign language users who have not used video relay. Nineteen of the questionnaires were obtained through sign language interviews and the rest by self-completion questionnaires.

Characteristics of respondents

The 120 responses from non-users (Table 1) showed a slight bias towards females (52.5%) and covered a very wide age range (Table 2).

(Table 1 overleaf)

Table 1
Source of completed questionnaires

	No.	%
Typetalk sample	41	34
SIGNMatters	32	27
Text comm. survey	12	10
Deaf Clubs	17	14
Schools	3	2.5
RNID	7	6
NDCS	3	2.5
Not known	5	4
Total	120	100

Table 2
Age range of respondents

	No.	%
Under 25	13	11
25-34	17	15
35-44	29	25
45-54	17	15
55-64	25	22
65-74	9	8
75+	4	3.5
Total	114	100

Respondents were predominantly white (92.5%), but 5% described themselves as Asian or British Asian.

The respondents' employment status is set out in Table 3.

Table 3
Employment status of respondents

	Men	Women	All
Full-time paid job	29 (51%)	17 (27%)	46 (39%)
Part-time paid job	4 (7%)	11 (18%)	15 (13%)
Unemployed looking for work	9 (16%)	2 (3%)	11 (9%)
Looking after home and family	-	5 (8%)	5 (4%)
Unable to work because of illness/disability	4 (7%)	6 (10%)	10 (8%)
Full-time student	5 (9%)	5 (8%)	10 (8%)
Retired	5 (9%)	12 (19%)	17 (14%)
Other	1 (2%)	4 (6.5%)	5 (4%)
Totals	57	62	119

Methods of communication used

More than 90% said they used BSL and more than 41% some other form of signing (Table 4), but half said they lip-read and just under one third used speech.

Table 4
Methods of communication used

	No.	%*
BSL	112	93
SSE/Total Comm.	49	41
Speaking	39	32.5
Lip-reading	60	50
Writing	51	42.5
Other	5	4
Total	120	

***** *Percentages do not add up to 100 as respondents could use more than one method.*

Table 5
Electronic equipment available at home

	No.	%*
TV	109	91
Textphone	97	81
Computer	95	79.2
Fax machine	81	67.5
Broadband	76	63
Webcam	49	41
Videophone	3	2.5
Total	120	

***** *Percentages do not add up to 100 as respondents could have more than one item of equipment*

Computers were commonplace in households (in almost 80%) and webcams surprisingly common (in more than 40%).

Some 44% said they had already signed to a deaf person using a computer and webcam, or videophone, but only 12 (10% of sample) did this regularly.

How respondents communicate with hearing people/organisations

Since a high proportion of the sample are from the Typetalk database (see Research Methods section), we have distinguished between these and other respondents in investigating means of communication with hearing people/organisations. However, a very high number of all respondents used Typetalk, both those from the Typetalk database and other respondents. (Table 6). Both those from the Typetalk database and other respondents currently make significant use of personal helpers to make telephone calls and are keen communicators by other electronic means. However a number of respondents said also that they would physically go to places to obtain information, particularly to a station to look at travel times.

(Table 6 overleaf)

Table 6
Means used to communicate with hearing people/organisations

	% in total sample	% in Typetalk sample	% in non-Typetalk sample
Phone with help of friend/relative	**55**	**51**	**57**
Phone with help of social worker/interpreter	**33**	**32**	**33**
Phone with the help of colleague	**33**	**24**	**38**
Typetalk(RNID)	**79**	**98**	**70**
Fax	**71**	**63**	**75**
Text (via mobile)	**85**	**80.5**	**87**
Email	**75**	**73**	**76**
Instant messaging	**43**	**37**	**47**
Visit or meeting with interpreter	**69**	**59**	**75**

How frequently would respondents use a low-cost video relay service?

Most respondents say they would use a video relay service (Table 7), and only 11% of those replying saying that they would never do so. A high proportion, 44.5%, would use it at least once daily. However, interviewees displayed a certain amount of caution, saying that it depended how reliable the service was, and how good the interpreters.

Table 7

Respondents' views of how much they would use a low cost video relay service

	No.	%
More than 5 times a day	16	14
2-5 times a day	29	26
Once a day	5	4.5
A few times a week	22	20
Once a week	4	4
A few times a month	12	11
Once a month	2	2
Very rarely	10	9
Never	12	11
Total	112	100
No answer	8	

Investigation was made of the possible differences between those who say that they would use video relay at least monthly and those who would use it rarely or never (Table 8). They are surprisingly few: differences are small between those from the Typetalk and non-Typetalk samples, between the sexes, and between users of all variants of sign language. Having a webcam in the house seems to make no difference to their interest in video relay.

It is difficult to define a profile of an aspiring video relay user. None of the slight indications of difference are statistically significant. People who use Typetalk at times seem more likely to say that they would use video relay than those who never use Typetalk. Retired people seem somewhat less likely to say that they would use video relay than others, though there no strong age differences, apart from the four over-75s, who were less likely to use it.

Table 8
Proportions who say that they would use a low-cost video relay service at least monthly

Respondents recruited from Typetalk sample	**%** 77	**Respondents recruited from other sources**	**%** 82
BSL interview	88	**Self-completion questionnaire**	79
Males	79	**Females**	82
BSL	80	**BSL+SSE**	79
BSL 1st preference	85	**SSL 1st preference**	69
Ever use Typetalk	84	**Never use Typetalk**	68
Have webcam at home	80	**No webcam at home**	81
Retired	69	**Not retired**	82

Table 9 investigates high potential use of video relay on the same variables. Again, differences are few, and none statistically significant, with one exception. Retired people are much less likely to say that they would use a video relay service two or more times a day, (verging on statistical significance at the 5% significance level).

Table 9
Proportions who say that they would use a low-cost video relay service at least twice a day

Respondents recruited from Typetalk data base	% 31	Respondents recruited from other sources	% 45
BSL interview	38	**Self-completion questionnaire**	41
Males	40	**Females**	40
BSL	41	**BSL+SSE**	38
BSL 1st preference	45	**SSE 1st preference**	31
Ever use Typetalk	43	**Never use Typetalk**	32
Have webcam at home	44	**No webcam at home**	37
Retired	43	**Not retired**	19

What video relay would be used for

Uses of video relay are indicated in Table 10.

Respondents appeared to discriminate carefully between different uses of video relay. Among interviewees there seemed to be a distinction in willingness to use a video relay service to communicate with friends and relatives. Several did not think that they would use it for this purpose, as it would be too impersonal, or they did not like someone else being in the conversation – they would prefer their current methods – usually texting on a mobile or email. However, one interviewee at least was enthusiastic about using video relay to communicate with relatives abroad rather than having to rely on his hearing son to do so.

Interviewees were cautious about their use of video relay, thinking carefully about the different potential uses, and their benefits or disadvantages against current means of communication. One, for example, said that he would prefer Typetalk to talk about building regulations, as interpreters might not understand. There was some hesitation about using video relay for medical issues, apart from making appointments, particularly respondents said, if they knew the interpreter. Several considered video relay would be good for complaints, as it would convey the emotion. There were also some people, who hardly ever communicated with hearing people themselves, who were enthusiastic about using video relay for most purposes. This included a woman in her 60s, who mainly communicated through her hard-of-hearing husband, or occasionally her hearing son, and who replied that she 'never' used most of the means of communication listed in Table 6 (except for an occasional fax, and texting to her son).

Table 10

Proportions of respondents who would use video relay for communication with various people/organisations

	Total sample %	Typetalk sample %
Hearing friends/relatives	61	61
For work: colleagues and customers	47	46
For education: schools, colleges etc	48	51
For health: GP	66	66
For health: hospital	61	59
Social Services	57.5	63
Local council (other issues)	51	49
For travel: timetables, costs etc.	47	44
Shopping and entertainment	42	44
Other companies (eg gas, electric)	46	39
Looking for work (eg Jobcentre Plus)	43	42
Legal (eg solicitor)	47.5	44
Other	14	27

Advantages of video relay

Non-users of video relay broadly concurred with actual users about the benefits of video relay (Table 11). Non-users of Typetalk often referred to their level of written English.

Table 11

Advantages of video relay

Proportions agreeing with statements about advantages of video relay:	%
Can use signing	87
Expresses emotion well	64
Quicker than typing	61
Gives more independence	48
My written English is not good enough for text relay	33
Other	7

What stops people from using video relay

Respondents viewed video relay very positively and did not expect too many inhibitions in their usage of a service (Table 12). Many did however anticipate equipment problems.

Table 12

Impediments to video relay

Proportions agreeing with statements about what would stop them from using video relay:	%
I'd never heard of it	22.5
I don't have the right equipment	37.5
It sounds too complicated	12.5
The equipment is too expensive for me	37
I don't need to use the phone much	17.5
I have difficulty in understanding other people's signing	10
I don't like a third party in the conversation	10
I don't really understand video relay	14
Other	7

Costs of video relay

Respondents were asked the maximum amount that they would be prepared to pay for their own equipment for video relay. As Table 13 indicates, the vast majority (83%) would not be prepared to pay more than £100.

Table 13

Amount would pay for video relay equipment

	No.	%
Less than £50	46	44
Up to £100	40	38.5
Up to £200	11	11
Up to £300	3	3
Up to £500	2	2
More than £500	2	2
Total	104	100

Clearly respondents saw video relay in terms of equality of access to the telephone and only a tiny percentage were prepared to pay more than the usual hearing person's rate for telephone calls.

Nearly all those interviewed had very strong views about wanting to be treated equally over this. One, for example, said that there should be equal access. It was not just for the deaf to pay more. The government should make equal access for everyone and everything. Another said that the cost should be exactly the same although they knew it was an additional cost – that was what the Disability Discrimination Act was there for.

Use of Typetalk if video relay were available

If a video relay service were available, almost half of the respondents who use Typetalk expected that their usage of text relay would not change, 38% that they would use it less and 13% not at all. Respondents interviewed were very cautious about this question, and obviously valued Typetalk. Quite a few said that they could not answer the question as it would depend on how good the video relay service was. They would want to check out the quality of the pictures, and of the interpreters.

Lipreaders and video relay

Sign language users are not the only potential beneficiaries of video relay. Although targeted to sign language users, we had one questionnaire returned from a non-signing lipreader who wanted to use video relay. We also received a response from the Association of Lipspeakers. They considered that many deaf people who do not sign, and whose first or preferred language is English, could benefit from a lipspeaking service, but do not use it or are not aware of it.

There is a huge shortage of lipspeakers at the highest level (level 3). Some members of the Association think that using video might be a way of addressing this shortage, though others are waiting for a larger screen and sharper picture. However, there were doubts as to whether a telephone relay service, as opposed to a service where the deaf and hearing person are in the same location, would be used much at present.

Conclusions

Altogether, a 12% response from sign language users was received from the Typetalk and SIGNMatters mailings. Though slightly low in comparison to some postal surveys, this was not unexpected, given the difficulty many sign language users have with written English. In fact, the actual rate of response may be higher as we know from replies (not used) that some recipients of the mailings were not sign language users.

Those sign language users who did reply recognised the value of video relay: only 11% of non-users of video relay saying that they would never use it, and almost half the respondents that they would use it at least daily, and 40% more often than this.

The favourable attitude towards video relay was reflected by the amount of predicted usage, the strength of agreement with the statements about the advantages of video relay, and the low proportions agreeing with the statements about the factors that might stop them from using video relay.

By far the greatest barrier to usage was access to, or expense of, equipment. Very few are prepared to pay more than £100. Cost of calls is also a strongly felt matter, with many of those interviewed stressing that deaf people should be treated equally with hearing people and not be penalised for being deaf.

The one group for whom there is fairly clear evidence of less interest in video relay is retired people, though two of the four over-75 year-olds said that they would use it.

Despite the welcoming attitude towards video relay, interviewees were realistic about it, wanting to be sure that the quality of both the pictures and

interpreting was good, and that it served a particular communication purpose well before they would use it regularly.

But are those who replied biased in favour of video relay, or do they reflect the sign language community in general? A number of comparisons of sub-groups were carried out, and there was little differentiation of characteristics between non-users, rare, occasional and frequent users. Notably, there was little difference between people recruited from the Typetalk database and the rest of the sample. However, much of the rest of the sample was recruited from readers of SIGNMatters, who again may be untypical of the sign language population. All of those who participated in a sign language interview were interested in using video relay. The majority of these came from two deaf clubs – people agreeing to be interviewed may have been more interested in video relay than the sign language population in general. However, at one club in particular, interviewees seemed to have little knowledge of what video relay was until it was explained to them.

We can conclude that the respondents from the Typetalk and SIGNMatters samples are not very different from the total population of sign language users. But we cannot rule out that our responses tended to be from those who are most interested in video relay. Taking our total response to mailings, we arrive at 10% of the total number of people mailed who say that they would use a video relay service. This is a very conservative estimate, but one we think can safely be extrapolated to the whole sign language population as a figure of the minimum number who would be interested in a video relay service**.**

This does not mean that this number of people would immediately acquire the necessary equipment. They have clearly expressed limitations on the amount they would be willing to pay. To balance this, doubtless some non-respondents will actually use a service. And of course the very existence of a widely-available video relay service will in itself be a recruiting mechanism for those unaware of its possibilities; (see Potential Demand section for further discussion of service uptake).

Interpreters' views of video relay

Generally, interpreters view video relay positively with more than 80% of those completing questionnaires willing to undertake it. The vast majority, however, wanted to do it part-time (one day a week). More than half were happy to interpret both from a home base (where most said they had a suitable space) and from a centre. Interpreters thought that video interpreting required significant experience, and that some additional training might be appropriate. Pay rates were expected to be the same as for face-to-face assignments. Interpreters viewed the greatest advantage of video relay as enabling a more efficient use of their time. The most pressing disadvantage they foresaw was interpreting a two-dimensional image – but most active video interpreters thought that this would ease with experience. Interpreters anticipated new types of assignments on video relay that would be shorter and would more closely resemble hearing people's use of the telephone.

Completed questionnaires have been received and analysed from 45 interpreters (several more arrived too late to be included). Follow-up telephone interviews have been carried out with four interpreters who have had some experience of video relay or video interpreting, one having had their experience in the United States.

Characteristics of interpreters

Most of our responses came from female interpreters (72%). This seems to be in line with interpreters as a whole (Brian et al, 2002).[3] Two-thirds (67%) were Licensed members of ALSI (LASLI), or Members of the Register of Sign Language Interpreters (MRSLI) or eligible for this. They covered a wide range of years of experience of interpreting, as indicated in Table 1, with three-quarters (76%) having four or more years experience.

[3] Brian, D., Brown, R., and Collins, J., *The organisation and provision of British Sign Language/English interpreters in England, Scotland and Wales* In-House Report No. 102, Department for Work and Pensions, 2002. Available at: http://www.dwp.gov.uk/asd/asd5/ih2002.asp#l (Retrieved 15.06.2006)

Table 1

Years of interpreting experience

	No.	%
Up to one year	2	4
1-3 years	9	20
4-6 years	12	27
7-10 years	13	29
More than 10 years	9	20
Total	45	100

Experience of video relay or video interpreting

Table 2
Experience of video relay or video interpreting

	No.	%
Video relay	3	7
Video interpreting	8	18
Video relay and video interpreting	8	18
Neither	24	58
Total	45	100

As Table 2 indicates, quite a high proportion had experience of video relay interpreting (25%), five out of the eleven saying that this was frequent, one of those with frequent experience being the interpreter from the United States. Another eight had experience of video interpreting, but not video relay interpreting.

Willingness to interpret for video relay services

A large majority of the interpreters (37, 82%) said that they would be willing to interpret for a video relay service, this figure being identical for those with and without experience of video relay interpreting (82%). Two interpreters said that they were not sure.

Although no particular reason for not wanting to undertake video relay interpreting was dominant, the following were the sorts of issues mentioned

- lack of opportunity for preparation;
- breadth of domains that would need to be covered;
- regional dialects in sign language;
- difficulties of receiving 3-D language on a 2-D screen;
- providers using video relay as a cheaper option for situations in which it is not appropriate, eg some health-related situations
- inability to select clients
- eye strain from viewing monitor
- no face-to-face interaction
- need for training

Location of video relay service

Just under half of the 37 interpreters willing to work for a video relay service would like to be able to work both at a video relay centre and at home (47%), while another five (14%) had no preference. Just under a third (eleven) would prefer to work at a video relay centre. Three interpreters (two women, one man) only wanted to work at home.

Over half of the interpreters would be willing to travel for up to one hour to reach the video relay centre (60%), and another quarter (24%) would be willing to travel for longer than this. There were no gender differences in this.

Time available for video relay interpreting

The interpreters were asked the maximum amount of time that they would be prepared to spend on video relay interpreting if this were based in a video relay centre local to them. Table 3 indicates that the majority (51%) would want to only spend a day interpreting at a video relay centre. Another quarter would be willing to spend two or three days interpreting there. The 'other' category refers to someone who said that they would be prepared to do up to five separate half-days.

Table 3
Maximum time would spend on video relay interpreting per week if this were based in local video relay centre

	No.	%
3 days	2	5
2 days	7	19
1 day	19	51
Half a day	6	16
Occasional hour	2	5
Other	1	3
Total	37	100

Table 4 looks at the maximum time that the 25 interpreters who are prepared to work at home would spend on video relay interpreting. The amount of time differs little from that which they would work in a video relay centre. Half would spend a day, and just over a quarter more than this.

Table 4
Maximum time would spend on video relay interpreting if this could be done at home

	No.	%
3 days	1	4
2 days	6	24
1 day	13	52
Half a day	2	8
Occasional hour	3	12
Total	25	100

Availability of suitable space at home

Respondents who would be willing to work from home were asked if they had a suitable space where they could be uninterrupted and have complete privacy. Over two-thirds (68%) said that they had, while almost a quarter (24%) said that they were not sure.

Rates of pay

Respondents were asked whether they would expect the same rate of pay for video interpreting as for face-to-face, or higher or low rates. A large majority, 87%, would expect the same rates for working at a video relay centre as for face-to-face interpreting, as would 70% for working at home. Four interpreters would expect higher rates of pay whether this was at a video relay centre or at home. One (not a video relay interpreter) said this was because it seemed to be a highly skilled area and suggested rates should be the same as for police or court work. One said that rates at home should be higher if this involved out-of-hours work.

Those willing to work from home were asked if they would expect to be paid for a full day only, for a minimum number of hours including standby time, or for the exact time spent on interpreting if this were at a negotiated rate. Well over half (58%) said that they would expect to be paid for a minimum number of hours, including standby time. Only two said that they would expect to be paid for the exact time, but both indicated that the rate should be higher than for face-to-face, while for interpreting at a video relay centre they would expect the same rate as for face-to-face interpreting.

Types of interpreter assignment

The respondents were given a list of types of possible face-to-face assignments and were asked whether they carried these out 'frequently', 'occasionally', 'rarely' or 'never'.

Table 5
Types of face-to-face assignments

	Frequently %	Never %
Businesses	73	2
Work with deaf professionals	60	2
Health	56	2
Community	40	2
Social Services	31	13
Other local government	29	4
Employment	27	4
Conference	16	16
Legal	11	38
Police	11	47
Theatre	7	69
TV	5	72

They were also given an 'other assignment' category and asked what this was. Just taking 'frequent' assignments, education and/or training (six – 13%) and mental health (five – 11%) were mentioned most often.

In another, open, question, respondents were asked whether there were any situations for which video relay was not suitable. There was a high rate of response to this question, with medical/some medical (27%), counselling (13%), and legal (22%) situations being those mentioned most frequently. Mental health, police work and child protection were mentioned by several respondents. A number (20%) also said that any kind of sensitive situation would not be suitable for video relay.

One respondent suggested the main use of video relay would be for making appointments, and several others mentioned introductory calls. Another pointed out that they often did a large amount of travelling to make a small number of calls for deaf professionals.

Skills and requirements needed for video relay interpreting

Respondents were asked whether they thought that ASLI membership/IRP registration, experience and the ability to cope with regional accents were necessary for video relay interpretation. The vast majority (89%) considered ASLI membership or IRP registration necessary. Not everyone gave experience as a requirement, and views on years of interpreting experience needed varied considerably (see Table 6), the most common answer being

two years. One respondent said that a high degree of interpreting and inter-personal skills were necessary, but that these were not always indicated by qualification, registration or years of experience.

Table 6

Years of interpreting experience required for video relay interpreting

	No.	%
Less than a year	1	2
1 year	6	13
2 years	9	20
3 years	4	9
5 years	5	11
7 years	1	2
Experience, but years unspecified	10	22
Experience not mentioned as requirement	9	20
Total	45	100

All respondents thought that ability to cope with regional accents was necessary.

Respondents were also asked if there were any other skills or requirements needed, and a high proportion (47%) suggested that there were such requirements. A third (33%) mentioned the need for training, some in use of the technology and others in procedures. The next most common requirement mentioned, by 24% of those replying (five), was ability or confidence with technology.

Asked if they had the skills for video interpreting, answers were divided equally (21 – 47% each) into those who said that had the skills and those who were not sure, with three respondents saying that they did not have the skills. Among those who wanted to do video interpreting, 51% considered that they had the skills, and 46% were not sure. The two respondents who were not sure whether they wanted to do video interpreting were also not sure of their skills. A much higher (statistically significantly) proportion of those with experience of video relay and /or video interpreting said that they had the required skills (74%) than did those with experience of neither (27%).

Advantages of a video relay service for interpreters.

Respondents were asked to indicate whether a video relay service would have the advantages for interpreters suggested in Table 7. It can be seen that more than half the 45 respondents agreed with each of the suggested advantages, and that reduction of travel time and more productive usage of time were cited most often.

Table 7

Advantages of a video relay service for interpreters

	No.	%
Reduces travel time	**33**	**73**
More productive use of time	**31**	**69**
Possibility of working from home	**25**	**56**
Social interaction at video relay centre	**24**	**53**
Other	**9**	**20**

The most common 'other' advantage seen was of increasing the availability of interpreting to deaf people. Other advantages were:

- the opportunity for a new experience
- the opportunity to work with a wider range of deaf people
- professional support at a video relay centre

Disadvantages of a video relay service for interpreters

Of all the possible disadvantages of video relay, the quality of the visual image generated most concern (Table 8) even for those who had experience of video interpreting. In telephone discussions with interpreters who had had experience of video relay, however, three out of four said that although the 2-D screen was difficult at first, that interpreters do get used to it. One said that it is actually easier, as deaf people sign more explicitly to make sure that they are understood. The fourth did think it more difficult.

Table 8

Disadvantages of a video relay service for interpreters

	No.	%
Difficult because of visual image	39	87
Difficult to interpret for unknown people	24	53
Difficult to interpret without prior preparation	27	60
Less interesting as not meeting new people, going to places	21	47
Other	16	36

Over a third of respondents took the opportunity to express other concerns and the main issue that emerged was not having enough control over the situation, in that they would not have the choice of interpreting assignments, as they did with face-to-face interpreting. A second concern was that lack of interaction and environmental clues would make interpreting more difficult.

Would a video relay change or extend the nature of interpreting assignments?

Seventy-six per cent of respondents thought that video relay would lead to shorter assignments and 36% to new types of assignment. The new types of assignment expected were mainly of the kinds of usage for which a hearing person often makes a phone call – calls to a travel agent, about council tax or finance, to make complaints, to NHS Direct. One suggested it would be especially useful for someone working in an office. Three respondents who work for one of the existing video relay services in the UK said it made possible calls between family members, and friends.

In a telephone follow-up call one interpreter gave a striking example of the effectiveness of a video relay call. A deaf lady had had some building work done, but the skip was not removed for weeks despite her letters. When she used Typetalk they hung up. When she made a video relay call, the skip was removed straight away.

Conclusions

This survey suggests a high degree of willingness of interpreters to work for a video relay service – with over 80% saying that they would do so, whether or not they have had experience of this. It is, of course, possible that the sample is unrepresentative, and that those more interested in video relay replied, but we believe that the bias is relatively small.

Half of the interpreters only wanted to work for a day on video relay, and another quarter for two or three days. No one wanted to work more than this for a video relay service. Whether they worked at a video relay centre or at home did not appear to make much difference, though over half would like to be able to work at home as well as at a video relay centre. Few said that they would just spend an occasional hour. It has been suggested by the existing services that a video relay service might make better use of interpreters by allowing them to work for the service for the occasional hour. However, this might apply more to interpreters who are currently not working because of family commitments rather than to the respondents. Respondents seemed willing to do a considerable amount of travelling to reach a video relay centre, more than half for an hour, and another quarter longer than this.

The greatest disadvantage of video relay interpreting was thought to be the 2-D image, although slightly fewer of those with actual experience of video interpreting thought this was the case. In fact, three out of four of those spoken to in follow-up interviews said that interpreters get used to this. This was also the view of the leader of the interpreting team of one of the fledgling services, with whom we had a telephone discussion.

Several interpreters stressed the need for training, and the need for confidence in using the technology.

Apart from the visual image, the main fears were of not being able to prepare or select assignments. However, this could probably be overcome in larger services, by having profiles of interpreters, and matching this with callers' requirements, as suggested by one of the video relay providers.

The most cited advantages, by over two-thirds of the respondents, were reduced travel time and making more productive use of their time. One mentioned making a long journey for a few calls for a deaf professional. Several mentioned the increased availability of interpreters for deaf people, though there were some fears of the service being used by service providers for unsuitable assignments. Three quarters thought it would lead to shorter assignments and nearly a third to new types of assignments – for information, for complaints, of the kind that are routine to hearing people but for which deaf people often rely on others. Interpreters who have worked for video relay services also mentioned that it would provide deaf sign language users the opportunity to converse with hearing friends and relatives for the first time.

Numbers of available interpreters

There is a lack of clarity about the number of interpreters qualified at the highest level, ie qualified to be a Member of the Register of BSL/English Interpreters or Licensed as a Member of the Association of Sign Language Interpreters. Most of those eligible to do so both register with the Independent Registration Panel and apply to become ASLI members, but some people are members of one and not the other, and some of neither.

By comparing the lists on the ASLI and CACDP (Council for the Advancement of Communication with Deaf People), we calculate that there are at least 333 UK sign language interpreters qualified at this level. However, we have not so far been able to determine the number of eligible interpreters who are on neither of the lists.

The number of interpreters of high calibre is critical for a video relay service, as it is agreed by both interpreters themselves and sign language users that the quality of interpreting is a key factor in the success of a video relay service.

Opportunities for learning BSL are relatively few – there are a lack of tutors, little training for tutors, few courses, and very limited funding for courses. The Council for the Advancement of Communication with Deaf People believes that government investment in training in this area is needed. Setting up a video relay service may well raise the profile of interpreting, and attract both new recruits and government attention.

Video Relay Technical Issues

Performance

The performance required from video systems for good signing and lip-reading is well established. Several studies have been made and these resulted in the ITU-T [4] producing a guidance document[5]. The document suggests that signing requires a frame rate of 25 frame/s to provide the necessary temporal resolution. This is largely because of the very rapid movements used in finger spelling. Lip-reading requires a similar performance in order to reproduce rapid movements of the face.

As well as meeting the temporal requirements, sufficient resolution must be provided so that the necessary detail can be discerned. The ITU says that Common Interchange Format (CIF) is adequate. CIF has a resolution of 352 x 288 pixels and is equivalent to conventional broadcast television. Under good conditions signing can be used at Quarter-CIF (QCIF) resolution (176 x 144 pixels) but it causes some strain for the users. Lip-reading can also be used at QCIF but it is necessary for the camera to be adjusted so that the face fills the screen.

The ITU also makes the suggestion that the end-to-end delay should be below 800 ms. This is much the same as is required for normal speech conversation. Hard-of-hearing people who use video to improve their comprehension of speech will be helped if the synchronisation error between sound and video is kept below 100 ms.

It is accepted that signers can adapt to poorer transmission quality, and we saw examples of this in our study, but it is clear that the performance indicated in the ITU document is necessary to make the experience comfortable. Lip-reading is much more difficult if the video quality is poor and the adaptation technique used with signing is not usually available.

We asked the operators of the existing video relay services about the performance required and they all gave answers consistent with the ITU document.

The amount of transmission bandwidth required is determined not just by the frame rate and resolution but is, in fact, dominated by the performance of the video coder/decoder (codec). Codecs compress the raw data from the

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[4] ITU-T is the International Telecommunication Union, Telecommunication Standardization Sector.

[5] *Series H, Supplement 1: Application profile – Sign language and lip-reading real-time conversation using low bit-rate video communication, 1999*. Available at: http://www.itu.int/rec/T-REC-H.Sup1/en (Retrieved 15.06.2006)

camera by using many special techniques such as examining the differences between successive frames, analysing and predicting the motion of objects etc. There are many different codecs in use today; some examples are H.261, MPEG2, H.263, MPEG4, Windows Media Video 9 and H.264. That list is roughly in order of improving performance. Most ISDN videophones use H.261 or H.263 while most broadcast digital TV uses MPEG2.

H.264 is the latest standard codec and was developed as a joint effort between the ITU and ISO (incidentally, ISO refers to it as MPEG4 part 10). The performance improvement provided by H.264 is transforming all types of video communications. The improvement over MPEG2 is a factor of three or four, depending on the content. This means that, for example, an MPEG2 system running at 2 Mbit/s could be converted to H.264 and run at about 500 kbit/s with the same performance.

H.264 is now appearing in videophones, in both standalone and PC-based implementations.[6] This is very significant because the performance improvement means that the ITU guidelines can be met using the standard ADSL upstream rate of 256 kbit/s. The video relay operators are aware of this and the use of H.264 means that the interpreters see a good picture from broadband users. Note that the transmission from the relay centre to an ADSL user is always better because the bit-rate is at least twice as much. This is, of course, good for the users because they see a very good picture of the interpreter but may not realise that the interpreter may have to struggle with a poorer picture of themselves.

Issues with end-user equipment and installation problems

Installation and commissioning is one of the main issues faced by the relay operators today. They feel they have to intervene to help the users get going but it costs a lot of time and money.

ISDN-based videophones have the benefit that installation is largely just a question of plugging them into the ISDN line. Unfortunately, the same is not true for videophones which use ADSL broadband connections. The main problem is that of IP addressing; in order to receive incoming calls, in a straightforward way, the user must have a fixed, public IP address. Not all ISPs offer this facility and, even if they do, the situation is further complicated by the use of routers containing firewalls and Network Address Translation (NAT) between the Internet and the video device. If a videophone is connected directly to an ADSL line, the problems are reduced but it is not

[6] In this report, the term 'videophone' is used to refer to a multimedia terminal, irrespective of its method of multimedia functioning; for example, a videophone may be a set-top box, a stand-alone device, a PC with camera or any other equipment that performs the same function.

advisable for a PC-based device to be directly connected in this way because of the huge security risks. All this means that many different setting are required for even a single video device, depending on how it is connected. The ITU has recently produced two new standards, which make it much simpler to solve the problems associated with firewalls and NAT, but they are not yet widely implemented.

IP-based videophones have to connect via a gatekeeper function which may be owned by the user, the relay service or some third party. This is another complicating factor. It seems that most users are happy to use the gatekeeper provided by the relay service but this may change in the future as users become more aware of other services.

Even if only one videophone model existed in the market, all the problems listed above would still exist. The fact that there are many different types adds enormously to the difficulties. The relay operators would like to reduce the number of models that they have to support but they realise that this approach is not really feasible except in very controlled circumstances such as a remote interpreting service.

It is very difficult to solve the problems remotely because of the communication difficulties that the users have. Sometimes, a hearing person can be called in to help and website FAQs are useful but we found that site visits are sometimes unavoidable.

It is difficult to quantify the costs associated with user support, especially as the existing systems are so small but it is clear that, as systems grow, there will be greater direct costs. However, an optimistic view is that future videophones will be more automated and require less setting up.

ISDN and broadband, and issues with using both

As mentioned above ISDN-based videophones have the benefit of simple set-up. However, the fact that a single ISDN line can only provide a bit-rate of 128 kbit/s means that the performance will usually be inferior to a good IP-based videophone on an ADSL line. In fact, even with an H.264 codec, ISDN videophones can not achieve the performance specified in the ITU guidelines. Nevertheless, signers have been using them for years; this is another illustration of the adaptability of skilled signers.

ISDN has the advantage that the connection is a dedicated type. This means that the end-to-end delay and bit rate are both constant. This results in higher-quality transmission than a broadband connection *at the same bit rate*. There is some debate about the comparison because the performance of a connection using the Internet depends on the levels of traffic existing at the time.

Upstream speeds available to broadband users are increasing as new technology is introduced into the network. Many users will soon be able to buy services with three or four times the upstream speed. This will remove any vestiges of a meaningful comparison between ISDN and Internet-based videophones.

There is a significant number of ISDN videophones in use around the world, many owned by deaf people. The relay operators feel that they have to support them. Commercial gatekeeper boxes usually have support for both types so it can be straightforward to offer a service. None of the relay operators offers ISDN support as a featured product today but all say that they can do so.

Technical issues of interpreters working from home

Working from home is an attractive option to some interpreters but there is a technical problem with doing so. The issue is with the provision of a suitable broadband connection to the home. If a standard ADSL line is used with a 256 kbit/s upstream rate then, as we saw above, it is necessary to use the H.264 codec to achieve the ITU performance guidelines. In normal relay operation, the interpreter's equipment would respond to the user with the same codec, so, if the user has an older videophone, the user will see a poor-quality picture of the interpreter. If the interpreter were located at the relay centre, where such bandwidth restrictions would not apply, the user would be very happy with quality.

There are two distinct solutions to this problem; one is to try to obtain a broadband connection using new DSL technology but these connections are not yet available everywhere and may require that the telephone line is relatively short. The other way of solving the problem is to use video transcoding such that the interpreter always uses an H.264 codec and the relay centre converts to the standard employed by the user. This process introduces extra delay and capital expense and may not be acceptable to the relay operators or users.

Mobile possibilities

Mobile phone networks can provide high-speed Internet access so it should be possible to provide the same relay services as a fixed, broadband user would experience. However, the 2G (GSM) networks can not normally provide the required bit rate and certainly not in each direction at the same time. This means that video relay is really only feasible on the 3G UMTS networks. Many 3G phones have video capabilities but these do not usually use IP techniques but use the H.324M mobile standard instead. H.324M uses a circuit-switched bearer at a fixed bit rate. Tests in Sweden have shown that this system can be acceptable for signing but it does not meet the ITU

requirements. Users seem prepared to accept a poorer performance for the sake of mobility.

Relay services can support H.324M in a similar way to ISDN, using gatekeeper hardware, but only one operator has the necessary equipment today. No service has been announced.

In the future, 3G networks will offer very high speeds for Internet traffic and IP-based mobile videophones could become common. These would be automatically supported by the existing relay services.

Another method of providing mobility is to use a videophone connected to a WiFi hotspot. These are quite well used for VoIP services today but the operators had no knowledge of people using them for video. It may be that the firewall and NAT problems are too difficult to solve until the technology moves on.

Can a reliable emergency service be provided?

Rules for access to the emergency services are handled by the Office of the Deputy Prime Minister, which would be involved if a video access were to be provided. There are many problems to be solved before such a service could be offered even if it were handled in the same way as a normal relay call. The main issues to be addressed are those of priority and location information. The call from the relay service to the emergency service would, of course, be carried through the PSTN with priority but it would be difficult to provide any priority on the Internet connection. The problems of location associated with any IP system are not yet solved and the emergency service would have to rely on the caller to provide the details.

Technical conclusions

Images transmitted by video communications can already be good enough for video relay purposes and further developments mean that quality is continually improving as transmission speeds increase and new codecs (coder/decoder) software are introduced. The latest codec, H.264, developed by ITU and ISO, is transforming video communications and is in use by two of the fledgling video relay services.

Broadband is now the transmission medium of choice and although ISDN videophones have some advantages such as relatively easy set-up, their transmission speeds and performance are inferior to those of widely available broadband services.

Upstream broadband speeds are now improving and becoming more widely available. Other issues permitting, this will enable interpreters to be based at

home or remote from dedicated centres, and, if used by deaf relay users, will provide better images to interpreters. (At present the images of interpreters transmitted from centres tend to be superior to those transmitted from homes and elsewhere by relay users.)

The provision of support for users in installing and commissioning their equipment is currently one of the biggest obstacles for service providers. There is an ever-growing number of devices on the market and it is impossible to provide recommendations that will stand the test of time. However, with such ongoing rapid developments, this issue will decrease in significance, probably markedly so in the next six to 12 months, as installation and commissioning becomes easier. PCs and webcams are likely to be the most popular user equipment. Dedicated videophones may also be attractive to some users, but may not save much in costs and will not eliminate installation difficulties. They are also unlikely to be upgradeable as video technology progresses. Nevertheless, dedicated videophones seem to be popular in the USA and are given away free to deaf service users by three of the eight relay service providers.

In mobile telecoms, video communications is really only currently feasible on 3G networks. Although 3G phones have video capabilities, at present they tend to support H.324M standards rather than IP (Internet Protocol) techniques. This can produce acceptable signing, but no service yet offers a relay based on H.324M. In the relatively near future, IP-based phones are likely to become more common and WiFi hotspots will probably be used for video communications when certain technological hurdles are overcome.

There are a number of problems in providing reliable access to an emergency service including providing priority on an Internet connection and having to rely on callers to give location information.

Estimates of UK Sign Language Users

Estimates of sign language users in the UK are usually given as 50,000, but figures between 30,000 and 70,000 are also quoted.

The figure is imprecise because of the immense difficulties in undertaking an accurate survey. A question about sign language use has never been included in the national Census (despite requests and some sympathetic responses). Any sample survey would entail very large confidence limits because of the relatively small proportion of signers in relation to the total population – in any case, a sample is likely to underestimate the numbers of signers because many will tend to be invisible to conventional sample survey methods. Other available sources such as local authority registers offer considerable underestimates because they are voluntary and partial registers.

The Open University course on Issues in Deafness,1991,says "BSL is probably used by at least 50,000 people as their only or preferred language". They based their estimate on three different published sources: *British Sign Language,* M. Deuchar, (London, Routledge and Kegan Paul, 1984); *Deaf Worlds,* S. Sainsbury, (London, Hutchinson Educational, 1986); and the BDA 1987 report called *BSL: Britain's fourth language*.

The Office of Population Censuses and Surveys' (OPCS) surveys of disability carried out in the mid-1980s gave an estimate of 62,000 people who used 'manual communication', but this definition included users of manual communication of various kinds, (eg because of speech problems and learning disability).

The Social Policy Research Unit at York University, using the original OPCS data tapes, identified those who had said (in answer to the survey questions) that they had difficulty using or couldn't use a voice telephone because of deafness and who also said they used sign language or 'manual communication' to communicate. This estimate for the GB population produced a figure of 21,000 although the confidence limits had to be large giving an upper limit of 35,000 (RNID, private communication, 2006).

Potential Demand

Estimating demand for a little-known service like video relay within a relatively small community of potential users from a small sample is fraught with difficulty, but the evidence that is available from a number of sources is surprisingly consistent. Three sources suggest that weekly users might number between 2,000 and 4,500 within a relatively short space of time – but a range of unrealistic assumptions are built into all of these calculations.

Estimate from Typetalk response

From the 377 non-user questionnaires sent to people on the Typetalk database, 34 people (9% of the total) said that they would use a video relay service at least every week, and 17 (4.5%) said that they would use it daily.[7] (These figures unrealistically assume that the 330 people who did not respond are not interested in video relay.)

Assuming that non-respondents are not interested in video relay, extrapolating the above figures to the entire sign language user population in the UK which may be between 30,000 and 50,000, the following estimates emerge:

- 2,706 weekly VRS users based on population of 30,000
- 4,509 weekly VRS users based on population of 50,000

These include:

- 1,353 daily VRS users based on population of 30,000
- 2,255 daily VRS users based on population of 50,000

Estimate from SIGNMatters response

Similar calculations can be made with SIGNMatters respondents. A total of 300 questionnaires were sent out, and 22 respondents (7.33% of the total) said that they would use a video relay service at least once a week, and 18

[7] These figures are slightly different from those in the section on non-users, as they include those completing a non-user questionnaire who said that they had used a video relay service, and those arriving too late to be included in the analyses detailed in that section.

(6%) said that they would use it at least once a day[8]. Again, assuming that non-respondents are not interested in video relay, the following estimates emerge:

- 2,200 weekly VRS users based on population of 30,000
- 3,667 weekly VRS users based on population of 50,000

These include:

- 1,800 daily VRS users based on population of 30,000
- 3,000 daily VRS users based on population of 50,000

Other considerations

The above figures are of course very tentative and based on a very small sample:

- it is unrealistic to think that all those who did not reply have no interest in video relay
- intentions of respondents will not convert fully into usage
- our sample respondents seem to be amongst the more affluent sections of the deaf community
- cost will inhibit uptake, (80% of respondents say they would not pay more than £100 for equipment)
- technological difficulties will inhibit uptake.

Extrapolating from existing UK service user numbers

Figures from the existing UK services do not provide adequate evidence on potential take-up. While there is some evidence of considerable interest, the current number of users is small largely because of technical problems for those using a computer and webcam, and, in one of the services, the prospect of high running costs after an initial free period, (figures are currently confidential).

Estimates from other countries

Sweden

If demand in the UK were on the same level as that in Sweden, there would be 1,875 (if the UK sign language population is 30,000) or 3,125 (if the

[8] *As above.*

population is 50,000) users, given that the estimated population of sign language users in Sweden is 12,000.

However, the Swedish situation differs markedly especially in the cost and supply of equipment. End-user equipment is expensive (£1,500 to £2,000) and is usually provided by a government agency: the county councils for use at home, the National Market Labour Board for new workers, or Social Insurance for people who have been working more than one year. Most sign language users in employment are provided with equipment but there are considerable queues for those who want to use video relay at home. In addition there are too few interpreters (only one to take calls at a time, for IP in 2005), and this severely restricts demand, and causes frustration to callers. The 3G service is experimental and limits the number of users. The service is also only available Monday to Friday, from 8am to 8pm. In this context, the dramatic growth in the use of the video relay service over the past two years is interesting to note (see table).

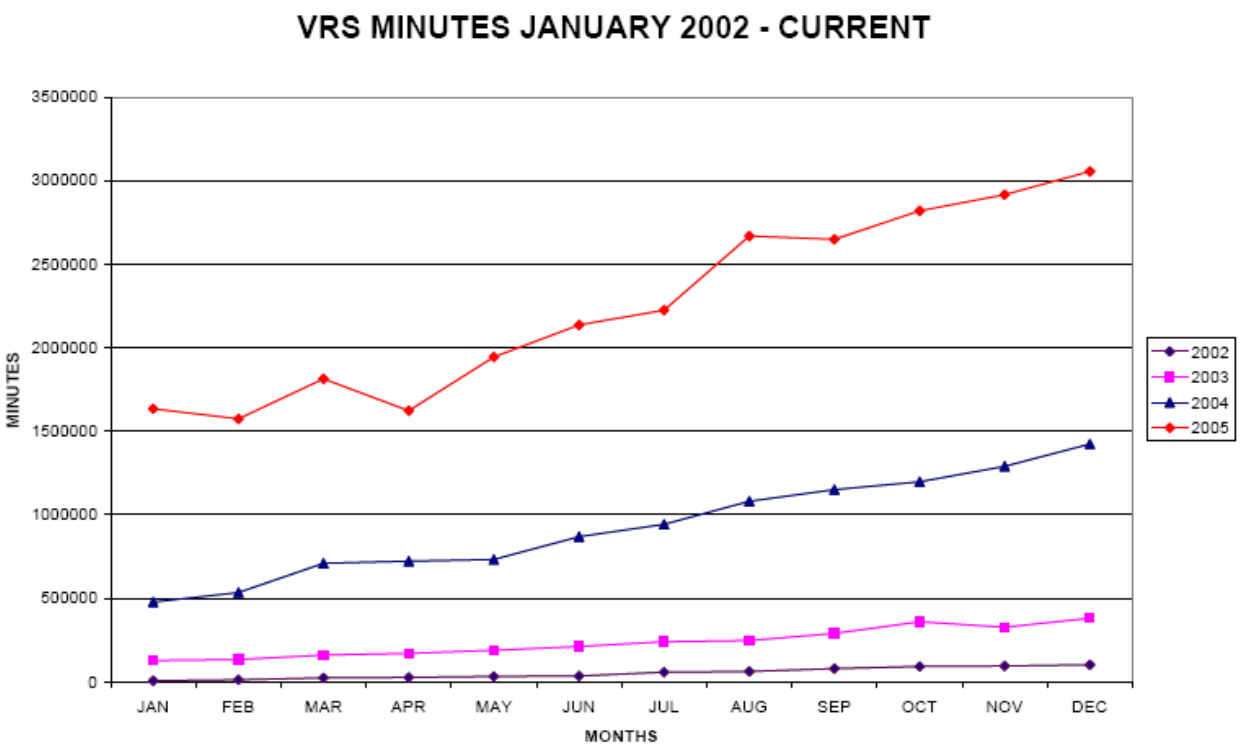
	ISDN	IP	3G	Total
2004	194	80	-	274
2005	50	500	50	600
Current	30	650	70	750

Source: Omnitor

There were 6,498 IP calls made in 2005, which averages about 13 a year per user. However, given the insufficiency of interpreters in Sweden, this probably gives little indication of the potential number of calls that would be made by UK video relay users.

USA

Video relay is a rapidly growing service in the US, as the graph below indicates**.**



Source: National Exchange Carrier Association, Inc. (NECA)[9]

The graph shows a slow start over the first two years and then an accelerating take-off. Total figures for video relay calls from July 2005 are seen in the Table below.

	Calls	Minutes
July 2005	503,656	2,229,789
August 2005	594,223	2,669,275
September 2005	592,426	2,648,275
October 2005	634,455	2,801,378
November 2005	650,965	2,925,398
December 2005	669,011	3,055,481
January 2006	960,720	2,922,190
Total	4,605,456	19,251,786

Source: National Exchange Carrier Association, Inc. (NECA)[10]

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[9] Available at: http://www.neca.org/media/0206VRSCURRENT.pdf (Retrieved 16.06.2006)

[10] *Video Relay Service Terminating Call/Minute Summary*, NECA, 2006 Available at http://www.neca.org/media/0106VRSTERMCALLSsummary.pdf. (Retrieved 15.06.2006)

There are currently eight providers in the US, and it appears to be possible to gain access to the video relay services using a variety of end equipment. This includes a PC and webcam, and D-Link i2eye videophone, which works with a TV and high speed broadband connection. One provider, Sorenson, has developed a specially designed videophone for deaf people, which also works with TV and broadband, and which can be obtained free by heavy users. Some other providers also offer free equipment.

Sorenson (2006)[11] estimate that only about 10% of American Sign Language users use video relay largely because non-users do not have affordable high speed broadband, live in rural areas where it does not yet reach, or are not aware of the service. Beginning in January 2006 providers had to offer a 24/7 service, and had to answer calls within a specified period of time so that users do not have a long wait to make a call. This may lead to an increase the number of calls made.

If the Sorenson figures on uptake are correct, and a UK service develops in the same way as the US, there would be between 3000 to 5000 users about four years after the service started. However, there are differences between the US and UK situations which will affect growth. Advances in technology, making installation easier for end-users, and increase in the speed of broadband in the UK in the next year are likely to accelerate growth. On the other hand, there are some additional favourable factors in the USA: video relay calls are free of charge, some communication providers give free equipment, and access is simple through one designated number.

Institutional demand in UK

There is a potential institutional demand in the UK – particularly from the NHS, Social Services and Access to Work. This demand is being investigated by the fledgling video relay services.

Potential rates of uptake

From our research of potential users, existing suppliers and historical parallels, we would tentatively suggest that the initial uptake of video relay is unlikely to overwhelm the supplier/s. We would anticipate an initial fairly sluggish response, (but bolstered by existing users of the fledgling services),

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[11] *Sorenson Communications opens six additional interpreting centers*. Press release March 23rd 2006 Available at: http://www.sorenson.com/press/press_release_full.php?pr_id=74&PHPSESSID=e12b3eddc66ff25d1588c4b9ec28e521. (Retrieved 12.06.2006)

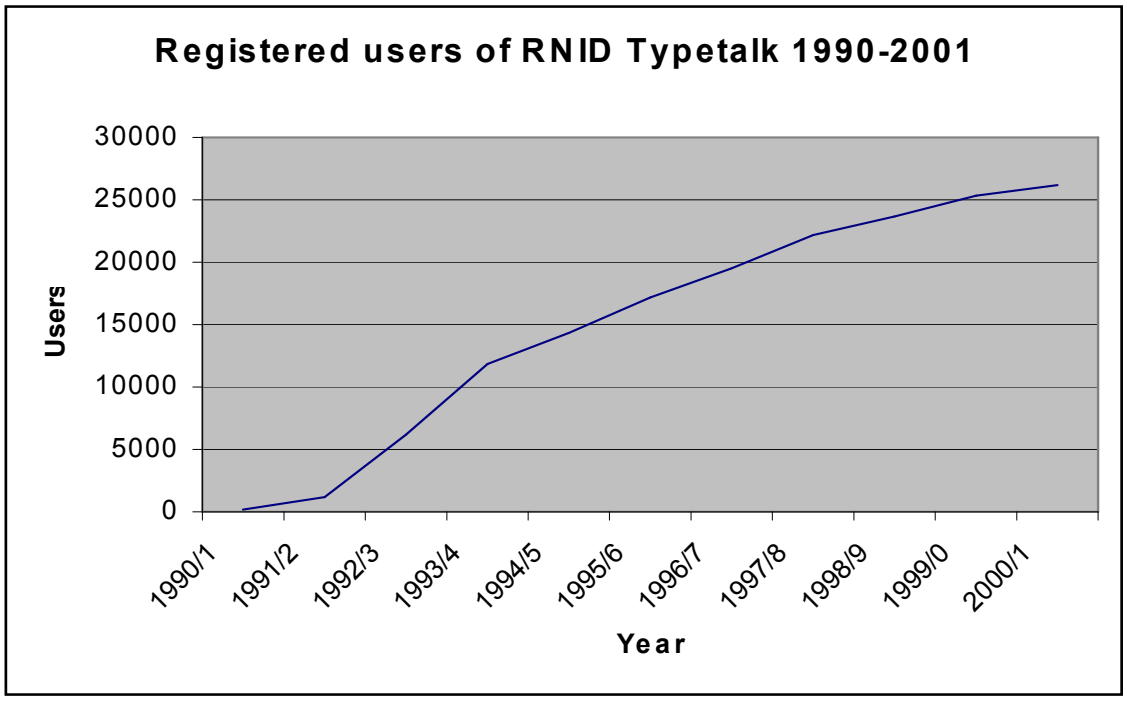
followed by a slow and steady increase as the technology becomes more familiar and the service capabilities are better understood.

Other possible models could be postulated, however:

- a logarithmic progression in which uptake increases rapidly until a saturation plateau is reached
- an early rapid take-off that levels off over time
- a steady rise until saturation levels are reached.

Fortunately, an historical parallel (even though it has distinct differences) does exist in the form of RNID Typetalk. The pattern of the initial uptake of Typetalk shows an early, relatively rapid take-up in the first four years, followed by a more gradual increase over the next six years, after which a levelling-off probably occurred. The withdrawal of the registration requirement means that comparable post-2001 statistics do not exist, but separate call statistics suggest that a levelling-off has occurred.

(See graph overleaf.)



Source: RNID Typetalk

Typetalk has several characteristics which may distinguish its rate of uptake from that of video relay.

Typetalk was not entirely new to hearing-impaired communities in 1990 – a prototype relay had already existed in the form of RNID's Telephone Exchange for the Deaf for four years and service had been restricted to about 200 users. So we would expect that latent, unsatisfied demand developed during that initial period and would have been likely to lead to an early surge in registrations once the full-scale relay service had been launched. In contrast, fledgling video relay services have been running for a much shorter period.

Typetalk also used a more familiar, relatively widely-used and better understood technology – the textphone. In contrast, video relay uses much more complex equipment that tends to be more expensive.

Typetalk has the potential to serve the needs of a much larger community, albeit in a more contrived way.

The above characteristics suggest that video relay uptake will be much smaller and less rapid.

However, video relay is more intuitive for both parties to use, quicker and more natural in conversational pace, and is probably a better fit for the needs of its smaller target user group.

Public Acceptance of Relay Services

The reaction of some hearing people and organisations to any form of relay call has posed concerns over the years in the UK – and elsewhere. In the context of this study, (with respect to research time and the recent appearance of the newer relay services), it has been impractical to gauge the impact of such services on hearing people, but the following gives an indication that speed and naturalness of conversations are likely to make them much more acceptable to commerce and the general public.

Legal Issues

Until recently, individuals in some banks have refused calls on the grounds that taking personal information from third parties conflicts with the Data Protection Act. However, this should cease to happen since a letter in February 2006 from the Information Commissioners Office (ICO) stated that there is no conflict as, by definition, the relay caller has given their consent to the imparting of their information in the relay call.

Video relay services seem not yet to be benefiting from the ICO statement as they are not regarded as official relay services. The issue appears not yet to have been explored with Captioned Relay.

Other issues

There are also concerns that receivers of calls do not understand the nature of relay calls and may not have the awareness or patience to deal with them. There are even reports that the voiceless delays that often precede text relay calls may lead some people to believe that they are receiving a spam/marketing call.

Because the new forms of relay – video and captioned relay – proceed at a much more rapid pace than text relay, and enable interruptions thus allowing more natural conversations, they are likely to be more popular amongst hearing users. (In the current form of captioned relay, Teletec claim that the deaf caller has complete control and that the operator has no role other than to re-voice what the hearing caller says. The virtual absence of a delay in communications, they say, means that no introductions or explanations are necessary.)

Deaf users of video relay claim that it is better received than text relay:

> *I have had positive feedback from people using the VRS as the speed of conversation is more fluid and faster than via text relay. And there is no jargon such as "Go Ahead" at end of each conversation bit.*

However there is still some confusion if a female interpreter is interpreting for a deaf male. This causes some hiccups whereas the text relay is more distinct as you clearly know that you are talking via a third party.

In video relay, even though the interpreter states that this is a VRS and explains the video relay service, the other person often becomes so comfortable that they forget the conversation is actually through an interpreter!

Manager of one of the fledgling services

The transparency of the interpreter was dramatically emphasised to a member of the research team who was listening to a US radio phone-in programme in which a deaf caller used video relay without it being apparent to the listening audience.

One of the video relay services is able to demonstrate to potential users how efficiently information can be received – and delivered:

As part of our usual demonstration evenings we set a challenge for deaf visitors asking them to call British Rail and ask for a price for a train leaving after 9am to Newcastle from London and check the return times on the same day. One is asked to do it through text relay and the other via video relay. The time differential is astonishing. We have recorded up to nine times faster via video relay (3.5 minutes against almost 35 minutes on text relay albeit with a strong BSL user and poor typing skills). The fastest typist even had a time difference of five times longer.

This increased speed of conversation obviously has a huge impact for deaf people – and by extension for hearing people participating in the conversation.

Funding and Costs of Relay Services

Additional relay services require funding to keep call charges similar to voice tariffs. There is no obvious best source of funds, but there is a model from the USA that imposes a levy on operators which could be adapted to the UK, and there are several government departments which it can be argued have good cause to provide some funding. Other ideas which relate funding to Disability Discrimination Act responsibilities and to third party ownership of relay infrastructure with tendering for service supply also emerged.

It is very clear that no additional relay services can be provided without funding from some source to keep call charges similar to voice tariffs. The main reason is that the running costs are high; this is because, like Typetalk, each call needs a sign language interpreter or communications assistant occupied for the duration of the call. When rest periods are taken into account it is hard to reduce direct operator costs below £1 per minute. If a service had to operate 24 hours a day then the costs would rise further. Discussions with operators of existing video relay services indicate that total costs are in the region of £3 to £6 per minute.

There is no obvious best source of funds. At present, Typetalk is funded by BT, originally because of one of the conditions of its operating licence. BT charges other operators for the use of Typetalk but the charges do not cover the cost of the calls. Recently, BT has made a very large increase in the charges it makes, presumably in an attempt to show what its real costs are. This action has certainly brought the issue into the open and funding of relay services is being considered again.

In the USA, all relay services are funded by a levy on network operators. The latest figures we have show that the fund runs at a level of about $400m per year. Companies tender for the provision of relay services and are paid out of the fund. There are many rules governing the provision of services and the operation of the fund; these are laid down by the FCC. The fund itself is administered by NECA (National Exchange Carrier Association). The reimbursement rates for relay companies are about $1.50 per minute for text-based relays and $6.60 per minute for video relays.

The USA model could be adopted in the UK, but the network operators are likely to consider it unfair that they should be the only contributors to the fund. Many of the people we spoke to felt that the government should provide at least a part of the funding through disability support schemes like Access To Work. Social services departments could also contribute although a national source of funding would be better than a multiplicity of local sources.

The NHS is a major user of remote sign language interpreting services using the same infrastructure as video relay. Perhaps the NHS could contribute

centrally to the fund and, in return, obtain interpreting and relay services at lower rates?

The logistics of collecting monies from several government departments is not easy and it is likely that some independent body or department would have to be set up to manage it.

Some other ideas came up during our research. One was that companies with significant telephone contact with the public should contribute to the fund as a way of meeting their responsibilities under the Disability Discrimination Act. Another idea, voiced by several people, was that a government body or independent company should own the relay infrastructure and others should tender for the provision of services using it. This is analogous to the way TV transmitters are no longer owned by the programme makers. The capital costs of the infrastructure could be met by government grants or some other mechanism.

From the deaf person's perspective, the issue is one of functional equivalence with hearing people's use of the telephone as a right.

All these ideas warrant further investigation.

Views of Communication Providers on Current and Additional Relay Services

There was a mixed reaction from telecom service providers to the provision of additional relay services. Only a few companies could be contacted in the time available. We encountered support in principle from a mobile operator once 3G was in a position to deliver the service widely at acceptably high quality, and reservation that other 3G technologies and innovations should be allowed to develop first because they might meet many of the needs of deaf people.

Three themes emerged through contacts with the telecom providers:

- the regulatory requirements to share costs and commitments
- the appropriateness of services
- the technological platforms and developmental potential for future relay services.

Sharing the commitment

From those contacted there would appear to be general acceptance that commitments and costs need to be shared. However, the possible precedent being set by General Condition 15 (GC15)[12] is causing considerable concern. On the one hand, those who have complied are concerned that other mobile operators have yet to comply, but no regulatory action is being taken. On the other hand, those who have complied are alarmed at the high connection cost per call that BT wants to charge.

Appropriate services

There is concern that the services currently provided by the existing relay service are not sufficiently dynamic or innovative and are failing to keep pace with technological developments.

Some operators point to the increasing uptake of mainstream communication methods such as email, Instant Messenger and SMS texting as an indication that deaf people want the same sort of services as everyone else.

[12] As a consequence of the 2003 Communications Act, Ofcom was given the power to impose conditions on telecommunications providers. The current set of conditions is contained in a notification dated 22 July 2003 and is an implementation of EU Directives. The document may be obtained from the Ofcom website at http://www.ofcom.org.uk/static/archive/oftel/publications/eu_directives/2003/cond_final0703.pdf . General Condition 15 relates to "SPECIAL MEASURES FOR END-USERS WITH DISABILITIES". Sections dealing with relay services are 15.3, 15.4 and 15.9

Platforms and developmental potential

There is some support for third party ownership of non-proprietary relay infrastructure that would enable innovation in relay services. This was seen as having several advantages including transparent cost-sharing and an encouragement to adopt mainstream platforms that have real developmental potential.

Captioned Telephony

The number of people who might potentially benefit from captioned relay is very high – between 420,000 and 1.2 million people are thought to have great difficulty in using voice telephony. However, many are older people who may be reluctant to use a new type of service. Although a proprietary service does exist, it is regarded as being very expensive and currently used almost exclusively with support through Access to Work funding. Nonetheless, captioned telephony is being very strongly advocated by hard-of-hearing people and their organisations. It is feasible to integrate a captioned relay with a text relay service. Improving speech recognition is likely to enhance current provision.

Captioned relay

Captioned telephone relay enables people with varying degrees of hearing loss to use (or more easily use) the telephone by displaying the text of the conversation on a special phone (or a PC). The person with hearing loss voices their part of the conversation in the usual way and can read the text and/or listen to the incoming speech.

The person with hearing loss needs a special telephone or terminal that can display the text relayed by the operator. Currently the only suitable model available is a CapTel telephone priced at £295 plus VAT.

Although the relay operator could type the text or "captions", it has been shown by a current service (Captel) that operators can re-voice the conversation which is then transcribed by speech recognition software trained to the operator's voice.

One of the most significant advantages of the speech recognition element of the service is that it speeds up the conversation to near-natural conversation pace. In one configuration of the system, hearing callers may be unaware that their speech is being converted to text.

Captel claims 95% speech recognition accuracy, although usage by the research team suggests that this figure might be lower. Accuracy is broadly comparable to that of Palantype speech-to-text transcription.

Captioned relay is similar to Typetalk's Voice Carry-Over (VCO) facility where the operator re-types the speech, but the Typetalk VCO service is often reported to be difficult to use because of frequent technical difficulties in setting up users' equipment for the call. As with text relay, calls can be initiated by non-captioned telephone users.

Potential demand

There are no precise figures for hearing loss in the UK, but the statistics that are available suggest that the number of people who could potentially benefit from a captioned relay service could be between 420,000 and 898,000 or even as high as 1.2 million.

The following are some of the most relevant statistics available:

UK population (National Statistics, 2004)	59.8 million
- with hearing loss (RNID)	8.7 million
- hearing aid wearers (maximum statistic) (Tiresias)	4.0 million
- with moderate difficulty using the telephone (Davis)	3.2 million
- with great difficulty using the phone (Davis)	1.2 million
- cannot use voice phone even with amplification (RNID)	420,000
- with severe hearing loss of 71-95 dB loss – most will have difficulty with phone (Ballantyne)	898,000
- with profound hearing loss of more than 96 dB (Ballantyne)	150,000

The above statistics which offer a reliable review of the existing evidence were collated by Hearing Concern using the following sources:

> **Davis A. (2004)** "Who are the consumers?" *Is Anyone Answering Now?* Hearing Concern/Phoneability seminar 3rd March 2004;[13]
> **RNID (2006)** *Facts and figures on deafness and tinnitus*.[14]
> **Tiresias (2006)** Tiresias website guidelines: *Hearing impairment and deafness;*[15]
> **Balantyne (2001)** Balantyne's Deafness 6th Edn 2001, Eds. Graham & Martin, London: Whurr.

The data shows that a very large number of people could benefit from a captioned telephony service. However, people with age-related deafness are often reluctant to accept their loss of hearing. Many do not obtain hearing aids until the problem has become severe. It is difficult to estimate how many would take up a service, but age is expected to be a strong inhibiting factor. The present pricing is prohibitive for most people but if such a service were funded in some way the take-up would be very much greater.

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[13] Available at: http://www.tiresias.org/phoneability/anyone_answer/3.htm. (Retrieved 12.06.2006)

[14] Available at: http://www.rnid.org.uk/information_resources/factsheets/deaf_awareness/factsheets_leaflets/?ciid=290313. (Retrieved 12.06.2006)

[15] (Available at; http://www.tiresias.org/guidelines/hearing.htm. (Retrieved 12.06.2006)

Articulation of demand

In the context of this study, we were unable to study the demand for captioned relay in depth, but the enthusiasm for such a service was abundantly clear from individuals and organisations alike.

Advocates point to several very important advantages of captioned relay:

- functional equivalence of captioned relay is very high: the pace of the conversation is very similar to a usual telephone conversation and interruptions are possible
- callers are often unaware of the presence of a relay operator
- no need for users to learn to type (many potential users are elderly)
- user interface is relatively simple
- users can use their hearing as far as it is possible and need only refer to captions when necessary
- helps in understanding unfamiliar voices
- the system is suited to many formal situations including employment and appointment-making.

Hearing Concern believes that the current CapTel service offers a close approximation to its definition of functional equivalence for hearing impaired users of voice telephony.

In the course of the study we came across many individuals for whom captioned relay held a strong appeal. Here are some responses from deaf people with speech who use telecoms heavily for social and work purposes:

> *I use CapTel at work and it's marvelous. My usage is funded through the Access To Work scheme. I used to have to rely on hearing helpers at work to assist with important calls, but now, with captioned relay, I am much more independent.*
>
> *I think captioned relay would replace my use of Typetalk and probably encourage me to make more calls. I use Typetalk about five or six times a week and always with VCO if possible. But if that isn't possible (because I often get cut-off for unknown reasons), I ask my hearing partner to help with calls. I also send and receive about 100 emails, and five or six texts over the course of a day as well as my Vodafone Communicator to keep direct contact with my partner.*
>
> *I would love to have captioned relay for work and home use but at the current availability and cost it is not going to happen! It would replace my use of Typetalk which I use continuously throughout the week with VCO for work and social purposes. But I'd continue to use email – I send and receive hundreds of emails each week. I also use text to text up to ten times a week, send and receive up to 15 text messages each*

week. I even use the voice telephone about ten times a year – but only in emergencies and with people I know.

All I need is some assistance in hearing what other people say in a phone conversation. In the past I've always used a normal telephone, but struggled with some people. I was only vaguely aware of textphones, but never looked at them because I didn't want something with a keyboard (the old fashioned looking textphones are embarrassing for someone who lives in a hearing world and used to up to date technology!). I have a textphone at home now, but hardly ever use it as it's too awkward and error prone when trying to use Typetalk VCO. As far as I knew there was nothing suited to my needs. In the last year my hearing worsen a little, so I started looking at alternatives... Eventually I found out about the CapTel phone, which I now have at work and this works well for me, as it's close to having a normal conversation (only difference is that sometimes I may have to wait a little for the text to display so I can read what the other person says). This is exactly the sort of service I need, though I would prefer a phone with smaller buttons like on most phones! Now I'm desperate to have a similar service and phone that I can use at home and on a mobile phone, and extremely frustrated there is nothing at present.

Experience from USA

The demand for captioned relay in the USA is growing rapidly and in November 2005 the Federal Communications Commission received a petition from 13 national consumer organizations to mandate captioned relay to be funded through the Interstate Telecommunications Relay Service Fund.[16]

Captioned telephony is funded by the same mechanism as other relay services in the USA. Tariffs are similar to ordinary voice calls. There are about six times as many conventional text relay calls as captioned calls but the service has not been running for very long, is not publicly available in 18 states, and severely restricted in others. Lengthy waiting lists are said to be developing in some states.

Ultratec's CapTel is the only captioned relay service available in the USA and is provided from a centre in Wisconsin. It currently operates over analogue technology rather than IP protocols.

US captioned telephone users report that their calls are being returned from hearing people on a regular basis, something that has proved problematic

[16] Available at: http://www.nad.org/atf/cf/%7BA2A94BC9-2744-4E84-852F-D8C3380D0B12%7D/CaptionedTelephonePetition.pdf (Retrieved 5.05.2006)
[17] Available at: http://www.neca.org/media/0406TRSStatus.pdf (Retrieved 15.06.2006)

with their existing text relay service. This increased responsiveness of hearing people is almost certainly chiefly a result of the faster, near-natural pace and style of captioned relay calls. The US campaign for captioned relay highlights the employment benefits of the service and how users report the greater acceptance of captioned relay (over text relay) in work situations. The petition calls for a captioned relay service that can deliver text at a minimum rate of 125 words per minute.

Standards for transmission of simultaneous voice and text

Captioned telephone systems need to be able to transmit text and speech simultaneously on the same line. In one configuration, the need is to transmit text in one direction and speech in the other. There are several standards for this; the ITU has V.61 and V.70. V.61 uses analogue techniques in a very clever way using a modified 14,400 bit/s modem. V.70 is purely digital and provides a mechanism for carrying multiple digitised voice streams multiplexed with text over a standard high-speed modem. The latter method works very well because speech codecs exist that can carry telephone-quality speech at rates of 8 kbit/s and below. Examples of these codecs are G.729 and G.723.1.

The existing services use proprietary systems but there is some uncertainty as to whether they are based on international standards.

As we move into the "everything-over-IP" age, it becomes simpler to carry speech and text simultaneously. All the video telephony standards have text capability so it's just a question of using a compliant videophone without the video.

The potential for speech recognition

Speech recognition technology has improved dramatically in recent years. The market leaders are Nuance (Dragon Naturally Speaking) and IBM (ViaVoice). Microsoft now includes speech recognition in the latest version of its Office product and its XP Tablet Edition operating system. Speech recognition will also be integrated within the future Vista operating system.

With careful attention to detail, very high levels of accuracy can be obtained. Accuracy and speed of response do not go together. For example, accuracy can be improved if the recognition engine is set to analyse complete sentences but this means extra delay. In normal conversational speech, people tend not to speak in complete sentences so this extra analysis is of limited use. In the captioned telephony case, speed of response is more important than accuracy because timely text actually improves the perception of the sound.

At present, speech recognition engines work best if they have been trained to a particular person's voice. This is why the existing captioned telephony system uses a human intermediary who re-voices the speech into a speech recognition system. Multiple speaker recognition is the holy grail of speech recognition developers and always seems to be ten years away. In the meantime, re-voicing will be used.

How could captioned telephony be provided?

We believe an affordable captioned telephony service would be popular. The provision of a service requires a very similar technical infrastructure to that of Typetalk. It would be feasible to add captioned services to the existing range. Special telephones would be needed because, in general, textphones cannot pass speech and text simultaneously. The only known manufacturer of such devices at present is Ultratec.

Speech Relay

There is little awareness of the potential of speech relay in the UK and it is only relevant to a specific type of speech impairment. Speech relay services do exist in at least three other countries, but we encountered very little demand for such a service in the UK.

A speech relay service is one in which a relay operator re-voices the speech of someone who has a speech impairment, but who can speak with an indistinct or faint voice, or with speech prosthesis. This service type is little known in the UK and rarely considered by potential UK beneficiaries.

Speech relay in the USA

In the US, STS (Speech to Speech Relay) became nationally available in 2001. The service is devised for use by people with speech difficulties related to cerebral palsy, multiple sclerosis, muscular dystrophy, Parkinson's disease, stroke, traumatic brain injury, stuttering or laryngectomy. America's STS is available for calls by and to people with a speech impairment, and is also available if one party to the conversation uses a textphone, VCO (voice carry over) or HCO (hearing carry over).

The STS "operator" is called a Communication Assistant, who re-voices the exact words of the speech-impaired person and is bound in confidentiality for the content of any conversation by federal law.

American STS calls are funded by a small surcharge on all phone users' bills, (as are other phone accessibility services). State by state, the STS system is run by commercial companies who bid to provide the service (as is also the case for other relay services). STS consumers pay nothing extra to make or receive their speech relay calls. (Long-distance relay call costs are discounted to reflect the extra time taken for relay.) Also, like other relay services, STS is available by dialling 711 anywhere in the US.

STS Relay first became available in the US in California, in 1997; the service became available nationally in March 2001. We have unconfirmed reports that in the USA, users of STS may number in the low to medium single-figure thousands. American STS traffic figures (for funding purposes) suggest that that STS call volumes equate to a fraction of one per cent of any other type of telephone relay service. (The latest figure available, February 2006, records that "interstate" [long-distance] STS calls comprised 16,015 minutes out of 2,242,129 minutes of all interstate assisted relay calls carried on PSTN networks - comprising 0.7 per cent)[17]

Speech relay elsewhere

Australia's National Relay Service (NRS) now provides a 7-day, 24-hour Speech to Speech Relay (SSR), which is also available for calls from overseas.

Speech-to-speech relay was originally pioneered in Sweden (where it is called TeleTal). There are mentions of speech relay services having been proposed in Denmark, New Zealand and South Africa on the Internet, but none of these yet appears to have been developed.

Speech relay in the UK

In Britain, the organisations we spoke to (serving groups such as those listed above, in connection with US STS) were unaware of speech relay services' potential.

Representatives of two stroke organisations highlighted the additional difficulties of some speech-impaired people in finding vocabulary, for which reason a relay re-voicing of words would not be effectively helpful for this group.

Stammerers would appear to receive little or no benefit from speech relay because their barrier to conversations tends to be delay which might even be exacerbated by a relay operator.

Other UK organisations' representatives felt that effective communication assistance should take forms other than speech-only relay.

Conclusions

We have not found a currently perceived role for a speech-to-speech relay service in the UK, without other integrated facilities such as –

- a communication assistant sitting beside, say, a stroke person using drawings, gestures and written words with which to develop intended meanings to be voiced by the assistant on the phone

- speech generation equipment, creating word sounds from inputs other than original speech

- more commonly, speech relay in conjunction with captioning, as more fully explored in the preceding section on captioned telephony.

Further research is needed concerning the communication needs of speech-impaired people to find the best means and appropriate service opportunities to assist them.

– End of Report –